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ABSTRACT

This document is a reference tool for the Maryland Community Colleges Technology Council (MCCTC). It contains a summary of MCCTC's creation and reviews its general initiatives to form a statewide technology affinity group, administer a technology needs assessment survey, and develop a statewide community college technology plan and funding strategy. The paper also defines "technology" and outlines MCCTC's mission statement and 1997-1998 objectives, focusing on the vision for Maryland Community Colleges and technological goals for students, faculty, staff, and the community. The glossary makes up the bulk of the document and includes selected computer-related terms used in council meetings, presentations, and publications. Not a comprehensive list, it is provided as a reference for council members and council publication readers. (YKH)

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Technology Defined

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Maryland Community Colleges Technology Council

Technology Defined

Compiled for the MCCTC by
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In October 1996, the Maryland Community College Facilities Planners Council presented *A Proposal for Enhancing Information Technology in Maryland Community Colleges* to the Maryland Council of Community College Presidents. Among the initiatives advocated in the proposal were creation of a statewide technology affinity group, administration of a statewide technology needs assessment survey, and development of a statewide community college technology plan and funding strategy. The council of presidents approved these initiatives.

The first meeting of the Maryland Community Colleges Technology Council (MCCTC) took place February 20, 1997, at Catonsville Community College. Council membership included 14 representatives of Maryland community colleges, including facilities planners, institutional researchers, data processing directors, a business officer, academic and continuing education administrators, and a student services dean. Between March and August, 1997, the MCCTC designed, conducted, and analyzed a survey of technology needs. The final report, *Maryland Community Colleges Technology Needs Assessment Survey*, was released in September 1997.

With the survey findings in hand, the Maryland Association of Community Colleges developed a draft bill for the 1998 General Assembly legislative session in Annapolis. Entitled "Innovative Partnerships for Technology" (IPT), the bill called for state matching of private donations to Maryland community colleges for technology up to $500,000 per college.

Definition of Technology

For the purposes of the IPT legislation, technology was defined as follows:

"Technology" means the hardware, software, communications infrastructure, and associated training and contracted services that enable local or global presentation, exchange, storage, and transmission of information in digital or analog form for teaching, learning, student support services, and administration. "Technology" may include capital expenditures. "Technology" does not include staff.

Council Mission and Goals

During the spring of 1997, the MCCTC developed a draft mission statement and established goals for 1997-98. These were circulated among other appropriate statewide community college affinity groups for comment. The mission and goals as drafted for comment were as follows:

(Draft) Mission Statement

- Develop a statewide technology plan addressing interoperability and connectivity issues and the technology funding needs of Maryland's community colleges.

- Develop a clear vision for statewide information technology development within and among the community colleges and their community partners.

- Provide an information exchange about exemplary programs and activities that utilize information technology to improve teaching and learning, enhance student access and community outreach, and facilitate the delivery of services to students and communities.

- Identify and recommend technology-related staff development and training programs for Maryland's community colleges.

- Provide advice on technology issues as requested by the Maryland Association of Community Colleges and the Maryland Council of Community College Presidents.

1997-98 Goals

- Develop, administer, and analyze a statewide community college technology needs assessment survey including instructional technology, intercampus networks and distance learning initiatives, technology support, administrative systems, and campus technology infrastructure.

- Work with the Maryland Association of Community Colleges to develop a technology funding strategy for the 1998 session of the Maryland General Assembly.

- Explore the feasibility and cost effectiveness of alternative means of providing a voice, video, and data network linking all 18 Maryland community colleges.

- Prepare a statewide Technology Plan for Maryland Community Colleges outlining a clear vision for information technology development.

A Vision for Technology in Maryland Community Colleges

In addition to the mission statement, a draft technology "vision statement" was developed during a visioning exercise conducted shortly after the Council was formed. This draft was presented to the Presidents' Council and shared with the other community college affinity groups. The purpose of the vision statement was to clearly define what Maryland community colleges want technology to do for their students, faculty, staff, and communities. The Council's technology plan will be designed to make this vision a reality.

(Draft) Technology Vision Statement

WHAT WE WANT TECHNOLOGY TO DO FOR STUDENTS

Improve learning by:

- providing more choices of what and how to learn

- facilitating self-directed, personalized learning

- assuring information literacy

Improve access to college for a broader audience of students by:

- removing time and location barriers
- diminishing dependence on the physical campus
- providing just-in-time learning and student services

Improve results by:

- preparing students to meet evolving workplace needs
- facilitating the credentialling of new packages of learning

WHAT WE WANT TECHNOLOGY TO DO FOR FACULTY

Support and improve instruction by:

- improving productivity
- expanding access to smart classrooms
- facilitating the delivery of instruction to multiple locations

Elevate the teaching role by:

- reinforcing role as designer/manager/monitor/credentialer of learning rather than dispenser of information
- facilitating the integration of new knowledge into the curriculum
- enabling faculty to be learners as well as teachers

Enhance faculty development and collegiality by:

- providing faculty with anytime and anyplace access to internal college data, external information resources, and colleagues

WHAT WE WANT TECHNOLOGY TO DO FOR STAFF

Enhance productivity by:

- broadening access to staff development opportunities
- freeing staff from routine, repetitive work

Improve the quality of services by:

- tailoring services to student and faculty needs
- providing services anytime, anywhere

Improve management and decisionmaking by:

- making decentralized organizational structures more functional
- enhancing the ability to manage rapid change
- improving access to research and management information
- expanding budgeting and spending flexibility

WHAT WE WANT TECHNOLOGY TO DO FOR THE COMMUNITY

Facilitate lifelong learning by:

- enhancing access to training, recreation, and cultural enrichment
- providing an electronic information gateway to the world

Enhance economic development by:

- developing and delivering education and training programs for new and existing business and industry anytime, anyplace
- utilizing the college as an electronic community center for information-based activities

Glossary

This glossary contains selected computer-related terms that have been used in Technology Council meetings, presentations, and publications. It is by no means a comprehensive list, but is provided as a ready reference for Council members and users of Council publications.

ANSI (American National Standards Institute): Voluntary organization of over 1,300 members including the large computer companies that creates standards for the computer industry.

applet: A program designed to be executed from within another application. Unlike an application, applets cannot be executed directly from the operating system. With the growing popularity of object linking and embedding (OLE) applets are becoming more prevalent.

application: A program or group of programs designed for end users. Applications software such as spreadsheets and word processors cannot run without an operating system and system utilities.

asynchronous: Not occurring at predetermined or regular intervals. Communications in which data can be transmitted intermittently rather than in a steady stream. A difficulty with asynchronous communications is that the receiver must be able to distinguish between valid data and noise. This is usually accomplished by a start bit and stop bit at the beginning and end of each piece of data. For this reason, asynchronous communication is sometimes called start-stop transmission. Most communications between computers and devices are asynchronous.

ATM (Asynchronous Transfer Mode): A network technology based on transferring data in cells or packets of a fixed size. The cell used with ATM is relatively small compared to units used in earlier technologies. The small, constant cell size allows ATM equipment to transmit video, audio, and data over the same network, and at high speed. ATM currently supports data transfer rates of up to 622 Mbps (megabits per second), compared to 100 Mbps of Ethernet network applications. ATM may be the answer to the

Internet bandwidth problem. ATM creates a fixed channel, or route, between two points when data transfer begins. This differs from TCP/IP, in which messages are divided into packets that can take different routes from source to destination. It is thus easier to track ATM data transfers, but ATM is less adaptable to sudden surges in network traffic. ATM service can be Constant Bit Rate (CBR), in which data are sent in a steady stream analogous to a leased line; Variable Bit Rate (VBR), in which data are sent unevenly through a specified throughput capacity--popular for voice and videoconferencing; Unspecified Bit Rate (UBR), which does not guarantee any throughput levels and is used for applications that can tolerate delays such as file transfers; and Available Bit Rate (ABR) that provides a guaranteed minimum capacity but allows data to be bursted at higher capacities when the network is free.

backbone: The main wire that connects nodes. The main network connections comprising the Internet are a backbone.

bit: Short for **bi**nary digi**t**, the smallest unit of information on a machine. A single bit can hold only one of two values: 0 or 1. More meaningful information is obtained by combining consecutive bits into larger units such as bytes. Computers are sometimes classified by the number of bits they can process at one time, or by the number of bits they use to represent addresses. A 32-bit machine might mean one that uses 32 bits to identify each address in memory, or one with data registers that are 32 bits wide. Whereas a larger register makes a computer faster, using more bits for addresses enables the computer to support larger programs. Graphics are often described by the number of bits used to represent each dot. A 1-bit image is monochrome, an 8-bit image supports 256 colors or grayscales, and a 24- or 32-bit graphic supports true color.

bit-mapped graphics: The hardware and software that represent graphics images as bit maps, such as BMP, GIF, PCX, and TIFF. A bit map is a representation of a graphics image consisting of rows and columns of dots. The value of each dot (whether it is filled in or not) is stored in one or more bits of data in computer memory. For simple monochrome images, one bit is sufficient to represent each dot, but for gray shades and colors each dot requires more than one bit of data. The more bits used to represent a dot, the more colors and shades can be represented. The density of the dots or resolution, expressed in dots per inch (dpi) or by the number of rows and columns (640 by 480), determines the sharpness of the image. To display a bit-mapped image on a monitor, the computer translates the bit map into

pixels. To print a bit-mapped image, the computer translates the bit map into ink dots. Optical scanners and fax machines transform text or pictures on paper into bit maps. Bit-mapped graphics become ragged when you shrink or enlarge them, in contrast to vector graphics which can be scaled.

bridge: A device that connects two local-area networks, or two segments of the same LAN. The LANs can be dissimilar; a bridge can connect an Ethernet with a Token-Ring network. Bridges are protocol-independent; they simply forward packets without analyzing and re-routing.

broadcasting: To simultaneously send the same message to multiple recipients. In a network environment, broadcasting sends a message to everyone on the network whereas multicasting sends a message to a select list of recipients.

browser: A software application used to locate and display Web pages. *Netscape Navigator* and Microsoft *Internet Explorer* are the most popular Web browsers.

bulletin board system (BBS): An electronic message center. Most BBSs serve specific groups, allowing users to view messages left by others and post their own messages.

byte: Binary term, a unit of storage capable of holding one character. On most computers, a byte is 8 consecutive bits. Large amounts of memory are measured in kilobytes (1,024 bytes), megabytes (1,048,576 bytes), and gigabytes (1,073,741,824 bytes). A disk that holds 1.44 megabytes is capable of storing approximately 1.4 million characters, or about 3,000 pages of information.

channel: A communications path between two computers or devices. It can refer to a physical medium (wire) or a set of properties that distinguishes one channel from another. For example, TV channels refer to particular frequencies at which radio waves are transmitted.

chat: Real-time communication between two users via computer. Once initiated, either user can enter text by typing on the keyboard and the entered text will appear on the other user's monitor. Not widely used since a telephone is easier, and messages that aren't urgent can be sent as e-mail.

chat room: A virtual room where a chat session takes place. A chat room is really a channel.

client-server architecture: A network architecture in which each computer or process on the network is either a client or a server. Servers are powerful computers dedicated to managing disk drives, printers, or network traffic. Clients are computers or workstations on which users run applications. Clients rely on servers for resources such as files and printers.

Compact Disc-Read-Only Memory (CD-ROM): A type of optical disk capable of storing up to 1GB of data, although the most common size is 630MB. A single CD-ROM has the storage capacity of 700 floppy disks. A CD-ROM cannot be erased or filled with new data. Because of their large storage capacity, CD-ROMs are useful for color graphics, sound, and video. CD-ROM drives come in a variety of speed designations (2X, 4X, etc.) corresponding to seek times (e.g., 320, 135-180 milliseconds) and data transfer rates (300K, 600K per second).

connectivity: The ability of a program or device to link with other programs or devices.

cookies: Messages given to a Web browser by a Web server. The browser stores the message in a text file called *cookie.txt*. The message is then sent back to the server each time the browser requests a page from the server. The main purpose of cookies is to identify users and prepare customized Web pages for them. When you enter a Web site using cookies, you may be asked to fill out a form providing information such as your name and interests. This information is packaged into a cookie and sent to your browser which stores it. The next time you go to the same Web site, your browser will send the cookie to the Web server, which uses the information to present you with pages customized for your use.

database: A collection of information organized so a computer can select desired data; an electronic filing system. Traditional databases are organized by field (a single piece of information), record (one complete set of fields), and file (a collection of records). An alternative design is a Hypertext database, in which objects (text, pictures, etc.) can be linked with any other object. Hypertext databases are useful for organizing large amounts of disparate information, but are not designed for numerical analysis. To access information from a database, you need a database management system.

data compression: Storing data in a format that requires less space than usual. Compressing or packing data is especially useful in communications because it enables devices to transmit the same amount of data in fewer bits. The CCITT has defined a standard data transmission technique for transmitting faxes (Group 3 standard) and for data communications through modems (CCITT V.42bis). File compression formats such as ARC and ZIP are commonly used for backup applications and database management systems. Bit-mapped graphics can be compressed to a small fraction of their normal size.

database management system (DBMS): A collection of programs that enables a user to enter, organize, and select data in a database.

data warehouse: A collection of data designed to support management decisionmaking. Data warehousing combines many different databases from across an entire enterprise.

domain name server (DNS): A program that turns the Web site address you see (the URL) into a corresponding numerical address that can be read by a computer. A DNS Lookup Failed error message indicates that your browser could not contact your domain name server or that the DNS was not aware of the site. The first thing to check is to make sure the domain name you typed is not misspelled.

download: To copy data, usually an entire file, from a main source to a peripheral device. Often used to describe copying a file from an on-line service or BBS, or copying a file from a network file server to a computer on the network.

EDI (Electronic Data Interchange): The transfer of data between different companies or organizations using networks such as the Internet.

e-mail: Electronic mail, or the transmission of messages over communications networks. Some electronic-mail systems are confined to a single computer system or network, but most have gateways to other computer systems.

Ethernet: A local-area network protocol developed by Xerox in cooperation with DEC and Intel in 1976. Ethernet uses a bus typology and supports data transfer rates of 10 or 100Mbps.

FDDI (Fiber Distributed Data Interface): A set of ANSI protocols for sending digital data over fiber optic cable. FDDI networks are token-passing networks and can support data rates up to 100 Mbps. FDDI networks are typically used as backbones for wide-area networks. FDDI-2, an extension of FDDI, supports transmission of voice and video information as well as data.

fiber optics: A technology that uses glass or plastic threads (fibers) to transmit data. A fiber optic cable consists of a bundle of glass threads, each of which is capable of transmitting messages at close to the speed of light. Fiber optic cables have much greater bandwidth than metal cables and can thus carry more data. Fiber optic cables are thinner, lighter, and less susceptible to interference, than metal cables. Data can be transmitted digitally rather than analogically. However, fiber cables are expensive to install and more fragile than metal. Fiber optic cabling is particularly popular in LANs.

firewall: A system designed to prevent unauthorized access to or from a private network. Firewalls can be implemented in both hardware and software or a combination of both. Firewalls are typically used to prevent unauthorized Internet users from accessing private intranets. All messages entering or leaving the intranet pass through the firewall, which examines each message and blocks those that do not meet specified security criteria.

firmware: Software that has been permanently written onto read-only-memory (ROM). Firmware is thus a combination of software and hardware.

flat file database: A simple database system in which each database is contained in a single table. In contrast, relational database systems use multiple tables to store information, and each table can have a different record format.

FTP (File Transfer Protocol): The protocol used on the Internet for sending files.

full-motion video: Images displayed at 30 frames per second. A two-hour movie at only 640x480 resolution would normally require 133 GB of storage and would need to be pumped to a video card at about 150 million bits per second. However, video can be easily compressed by a large factor. This is because every image displayed has large areas of redundancy that can be represented by an encoding algorithm; the changes between consecutive

frames are usually small and algorithms can be used to describe a frame only by the changes that it represents from the one before (dramatically reducing storage requirements and the time to transmit each frame); and the human eye is not sensitive to certain details in a video, which can thus be removed without appreciable loss in perceived signal. The most popular compressed video format is MPEG (Motion Pictures Expert Group) that can typically compress as high as 100 to 1, bringing a two-hour movie down to 1.33 GB. Decompressing video data requires considerable processing power, and thus dedicated MPEG decoders are common. A high-quality decoder will display full-screen, smooth video animation. Cheaper hardware or software solutions can produce choppy or lower-resolution images.

gateway: A combination of hardware and software that links two different types of networks. Gateways between e-mail systems allow users on different e-mail systems to exchange messages.

gigabyte (G or GB): One gigabyte is equal to 1,024 megabytes.

graphics interchange format (GIF): A bit-mapped graphics file used by the World Wide Web, CompuServe, and many BBSs. GIF supports color and various resolutions, and includes data compression useful for scanned photos.

handshaking: The process by which two devices initiate communications. Handshaking begins when one device sends a message to another device indicating it wants to establish a communications channel. The two devices then exchange several messages to enable them to agree on a communications protocol.

hardware: Refers to boards, chips, disks, disk drives, display screens, keyboards, printers, and other physical objects you can touch. In contrast, software is untouchable--the computer instructions or data that are stored electronically.

home page: The main page of a Web site. Typically the home page serves as an index or table of contents to other documents stored at the site.

hot links: Icons that when you click on them take you to another object in a Hypertext system such as the World Wide Web.

HTML: Hypertext Markup Language, the language used to create documents on the World Wide Web.

HTTP: Hypertext Transfer Protocol, the underlying protocol used by the World Wide Web. HTTP defines how messages are formatted and transmitted, and what actions Web servers and browsers should take in response to various commands. For example, when you enter a URL in your browser, this sends an HTTP command to the Web server directing it to fetch and transmit the requested Web page. The other main standard that controls how the Web works is HTML, which covers how Web pages are formatted and displayed. HTTP is a stateless protocol because each command is executed independently, without any knowledge of the commands that came before it. This shortcoming is addressed by Java, JavaScript, ActiveX, and cookies.

hyperlink: An element in an electronic document that links to another place in the same document or to an entirely different document. Typically, you click on the hyperlink to follow the link. Hyperlinks are the essential ingredient of all hypertext systems, including the World Wide Web.

hypermedia: An extension to hypertext that supports linking graphics, sound, and video elements in addition to text. The World Wide Web is a partial hypermedia system since it supports graphical hyperlinks and links to sound and video files.

hypertext: A database system in which objects (e.g., text, pictures, sound, programs) can be linked to each other. When you select an object, you can see and move to all the other objects linked to it, even if they have different forms. The icons you select to view associated objects are called hypertext links or buttons.

interactive: Accepting input from a human. Interactive computer systems are programs that allow users to enter data or commands. A noninteractive program is one that, once started, continues without requiring human contact. A compiler is a noninteractive program, as are all batch processing applications.

Internet: A global web connecting more than a million computers located in over 100 countries. As of November 1997, there were an estimated 30 million Internet users. Unlike centrally controlled online services, the Internet is decentralized by design. Each Internet computer, called a host, is

independent and can choose what Internet services to provide.

Internet Service Provider (ISP): A company that provides access to the Internet. Typically, users pay a monthly fee for a software package, username, password and access phone number, then log on to the Internet to browse the World Wide Web and send and receive e-mail. ISPs serve individuals and companies. The ISPs themselves are connected to each other through network access points or NAPs.

intranet: A network based on TCP/IP protocols belonging to an organization and accessible only by the organization's members or to others with authorization. An intranet's Web sites look and act just like any other Web sites, but the firewall surrounding an intranet prevents unauthorized access.

ISDN (Integrated Services Digital Network): An international communications standard for sending voice, video, and data over digital telephone lines. ISDN requires special metal wires and supports data transfer rates of 64 Kbps (64,000 bits per second). Most ISDN lines offered by telephone companies provide two lines at once, called B channels. You can use one line for voice and one for data, or use both for data to provide data rates of 128 Kbps. The original ISDN uses baseband transmission. B-ISDN uses broadband transmission and can support transmission rates of 1.5 million bps, but requires fiber optic cabling.

Java: A high-level programming language developed by Sun Microsystems. It is an object-oriented language similar to C++, but simplified to eliminate common programming errors. Java source code files (with *.java* extension) are compiled into a format called bytecode (files with a *.class* extension) which can than be executed by a Java interpreter. Compiled Java code can run on most computers because Java interpreters and runtime environments--Java Virtual Machines (VMs)--exist for most operating systems, including UNIX, Macintosh OS, and Windows. Bytecode can also be converted directly into machine language by a just-in-time (JIT) compiler. Java is well suited for the World Wide Web. Small Java applications called Java applets can be downloaded from a Web server and run on your computer by Java-compatible browsers such as Netscape Navigator or Microsoft Internet Explorer.

JavaScript: A scripting language developed by Netscape to enable Web authors to design interactive sites. Developed independently of Java, JavaScript can interact with HTML source code enabling Web authors to

include dynamic content in their sites. JavaScript is an open language that anyone can use without purchasing a license.

listserv: When in all caps, refers to an automatic mailing list server developed for BITNET in 1986. When e-mail is addressed to the listserv, it is automatically broadcast to everyone on the list. LISTSERV is a commercial product; listserv is a generic term for any mailing list server.

local area network (LAN): A network of computers located near each other, e.g., in the same building.

mailing list server: A server that manages mailing lists for groups of users.

mainframe: Large computer capable of supporting hundreds or even thousands of users simultaneously. Unisys and IBM are the largest manufacturers of mainframes.

Majordomo: A free mailing list server that runs under UNIX. When e-mail is addressed to a Majordomo mailing list, it is automatically broadcast to everyone on the list. The result is similar to a newsgroup, except that the messages are transmitted as e-mail and are therefore available only to individuals on the list.

megabyte (M or MB): One megabyte equals 1,048,576 bytes of storage. When used to describe data transfer rates (e.g., MBps), it refers to one million bytes.

minicomputer: A mid-sized computer, in between workstations and mainframes in size and power. Minicomputers typically support between 4 and 200 users simultaneously. The VAX made by Digital Equipment Corporation is a popular minicomputer.

multimedia: The use of computers to present text, graphics, video, animation, and sound in an integrated way. CD-ROMs are the typical media.

Multipurpose Internet Mail Extension (MIME): A specification for formatting non-ASCII messages so they can be sent over the Internet. Many e-mail clients support MIME so they can send and receive graphics, audio, and video files via the Internet mail system. MIME supports messages in character sets other than ASCII. GIF and PostScript are predefined MIME types. Web browsers support various MIME types, enabling them to display

or output files that are not in HTML format.

network: A group of two or more computer systems linked together. Often characterized by their topology or geometric arrangement (bus, star, or ring), their protocol or rules and signals for communicating (e.g., Ethernet, token-ring), their architecture (peer-to-peer, client/server), and their geographic dispersion (local area or wide area). Computers on a network are sometimes called nodes. Computers and devices that allocate resources for a network are called servers.

newsgroup: An on-line discussion group or forum. To view and post messages to a newsgroup, you need a news reader program that connects you to a news server on the Internet.

noise: Interference or static that destroys the integrity of signals on a line. Noise can come from radio waves, nearby electrical wires, lightening, and bad connections. A major advantage of fiber optic cabling is that it is much less susceptible to noise than metal cabling.

OLE (Object Linking and Embedding): A compound document standard developed by Microsoft that enables you to create objects with one application and then link or embed them in a second application. Embedded objects retain their original format and links to the application that created them.

on-line service: A business that provides subscribers with data transmitted over telecommunications lines. On-line or online services provide an infrastructure for e-mail, forums, and connections to an almost unlimited number of third-party information providers. Profit-making online services include America Online and Compuserve.

operating system: A program needed by a computer to run other programs. Operating systems perform the basic tasks of recognizing input from the keyboard, sending output to the display screen, keeping track of files and directories on disks, and controlling peripheral devices such as disk drives and printers. Operating systems on larger systems act as traffic cops, ensuring that different programs and users running at the same time do not interfere with each other and ensuring system security by preventing unauthorized users from accessing the system. Operating systems such as Windows provide the software platform upon which applications programs run. Multi-user operating systems allow two or more users to run programs

at the same time. Multiprocessing operating systems support running a program on more than one CPU. Multitasking operating systems allow more than one program to run concurrently. Multithreading operating systems allow different parts of a single program to run concurrently.

optical disk: A storage medium from which data are read and to which data are written by lasers. Optical disks can store much more data than magnetic media such as floppy and hard disks.

PBX: Short for private branch exchange, a private telephone network used within an enterprise. Users of the PBX share a certain number of outside lines for making telephone calls external to the PBX. Organizations use PBX because it is cheaper than connecting an external telephone line to every phone in the organization. It is also easier to call someone within a PBX because fewer digits need to be dialed.

plug-in: A hardware or software module that adds a specific feature or service to a larger system. Plug-ins for Web browsers enable them to display different types of audio or video messages.

PostScript: A page description language (PDL) developed by Adobe Systems. An object-oriented language that treats images, including fonts, as collections of geometrical objects rather than as bit maps. PostScript fonts are scalable and can produce a multitude of fonts from a single typeface definition. Object-oriented or vector graphics can take advantage of high-resolution output devices that bit-mapped images cannot. A PostScript drawing looks much sharper on a 600 dpi printer than a 300 dpi printer; a bit-mapped image would look the same on both printers.

program: An organized list of instructions that when executed cause a computer to behave in a predetermined manner. Programs may be written in high-level languages (e.g., C++, COBOL, FORTRAN, LISP) or low-level languages (assembly language) which are closer to the machine language a computer can understand. The translation from high-level or assembly language to machine language is performed by compilers, interpreters, and assemblers. Purchased software is already in machine language, compiled and assembled and ready to execute.

protocol: An agreed-upon format for transmitting data between two devices. A protocol determines how the sending device will indicate it has finished sending, how the receiving device will indicate it has received a

transmission, the type of error checking to be used, and the data compression method used, if any. A computer must support the appropriate protocol to communicate with another computer. A protocol can be implemented either in hardware or software.

pull: To request data from another program or computer. The World Wide Web is based on pull technology where the client browser must request a Web page before it is sent. Increasingly, information services are harnessing the Internet to broadcast information using push technologies.

push: To send data to a client without the client requesting it. E-mail is a push technology since you receive mail whether you ask for it or not (the sender pushes the message to the receiver). Broadcast media are push technologies since they send information regardless of whether anyone is tuned in.

RealVideo: A streaming technology developed by RealNetworks for transmitting live video over the Internet. RealVideo uses a variety of data compression techniques and works with normal IP connections as well as IP Multicast connections.

relational database: A database that stores data in the form of a table. A single database can be spread across several tables, in contrast to flat-file databases in which each database is self-contained in a single table.

server: A computer or device on a network that manages network resources. A file server is a computer and storage device dedicated to storing files. Any user on the network can store files on the server. A print server is a computer that manages one or more printers. A network server is a computer that manages network traffic. A database server is a computer system that processes database queries. Servers are often dedicated, meaning they perform no other tasks besides their server tasks.

software: Computer instructions or data that can be stored electronically. Software can be systems software (the operating system and utilities that enable a computer to function) or applications software (the programs that do the work for users such as database management systems, spreadsheets, and word processors.)

standard: A definition or format that has been approved by a recognized standards organization or is accepted as a de facto standard by the industry.

Standards exist for programming languages, operating systems, data formats, communications protocols, and electrical interfaces. Standards are important because they allow products from different manufacturers to work together.

streaming: A technique for transferring data such that it can be processed as a steady and continuous stream. Important for Internet users because most do not have the capability to download large multimedia files quickly. With streaming, the client browser or plug-in can start displaying the data before the entire file has been transmitted. For streaming to work, the receiver must be able to collect the data and send it as a steady stream to the application that is processing the data and converting it to sound or pictures. If the streaming client receives the data more quickly than required, it needs to save the excess in a buffer. If the data do not come quickly enough, the presentation will not be smooth.

supercomputer: The fastest type of computer, employed for specialized applications requiring immense amounts of mathematical calculations, such as weather forecasting and fluid dynamics research. A supercomputer channels its power into executing a few programs as fast as possible, while a mainframe uses its power to execute many programs concurrently.

synchronous: Occurring at regular intervals, regulated by a clock. Communication within a computer is usually synchronous, while communication between computers and devices is usually asynchronous in that it can occur at any time and at irregular intervals.

T-1 carrier: A dedicated phone connection supporting data rates of 1.544Mbits per second. A T-1 line consists of 24 channels, each supporting 64Kbits per second. Each 64Kbit/second channel can be configured to carry voice or data traffic. Most telephone companies will provide fractional T-1 access by selling individual channels. T-1 lines are popular leased line options for businesses connecting to the Internet and for ISPs connecting to the Internet backbone. The Internet itself consists of faster T-3 connections. T-1 lines are sometimes called DS1 lines.

T-3 carrier: A dedicated phone connection supporting data rates of about 45Mbits per second. A T-3 line consists of 672 individual channels, each supporting 64Kbits per second. T-3 lines are used mainly by ISPs connecting to the Internet backbone and for the Internet backbone itself. T-3 lines are sometimes called DS3 lines.

TCP/IP (Transmission Control Protocol/Internet Protocol: The suite of communications protocols used to connect hosts on the Internet. TCP/IP is built into the UNIX operating system used by the Internet, and is thus the de facto standard for transmitting data over networks.

Token Ring: A PC network protocol developed by IBM. Token ring networks consist of computers schematically arranged in a circle. A token or special bit pattern travels around the circle. To send a message, a computer catches the token, attaches a message to it, and then lets it continue around the network.

upload: To transmit data from a computer to a bulletin board service, mainframe, or network.

USENET: A worldwide bulletin board system that can be accessed through the Internet or other online services. The USENET contains thousands of newsgroups that cover every imaginable interest.

vaporware: Software products that have been announced but are not yet available.

virtual: Not real. Distinguishes the conceptual from the physical. Virtual memory is an imaginary set of locations or addresses where you store data. It is imaginary in that the memory area is not the same as the physical memory composed of transistors. The mind is a virtual brain.

webcasting: Using the World Wide Web to broadcast information. Unlike surfing, which relies on a pull method of transferring Web pages, webcasting uses push technologies. The most popular webcasting service is PointCast.

Web page: A document on the World Wide Web. Every Web page is identified by a unique Uniform Resource Locator or URL.

Web server: A computer that delivers (serves up) Web pages. Every Web server has an iP address and possibly a domain name. For example, if you enter the URL <http://www.craig.com/index.html> in your browser, this sends a request to the server whose domain name is *craig.com* which then fetches the page named *index.html* and sends it to your browser. Any computer can be turned into a Web server by installing server software and connecting the machine to the Internet.

Web site: A location on the World Wide Web. Each Web site contains a home page, which is the first document users see when they enter the site. The site might also contain additional documents and files. Each site is owned by an individual, company, or organization.

wide area network (WAN): A network of computers dispersed geographically and usually connected by telephone lines or radio waves.

World Wide Web: A system of Internet servers that support documents formatted in HTML, providing links to other text, graphics, audio, and video files by clicking on icons. Not all Internet servers are part of the World Wide Web. Browsers make it easy to access the World Wide Web.

Year 2000 problem: The pervasive problem that many computer applications were written to handle only 20th-century dates beginning with "19". Most programs represent dates in the form MM-DD-YY, such that there is no way to distinguish between the years 1905 and 2005, for example. The problem, also known as the Millennium bug or Y2K problem, affects a vast amount of software, particularly accounting and database systems. The U.S. Social Security Administration estimates that it will need to review 50 million lines of code to correct the problem in its system.

For a comprehensive dictionary of computer-related terms, see <www.pcwebopaedia.com>.